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116TH CONGRESS
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H. R. 5374

To establish and support advanced geothermal research and development programs at the Department of Energy, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

DECEMBER 10, 2019

Mr. LUCAS (for himself and Ms. JOHNSON of Texas) introduced the following bill; which was referred to the Committee on Science, Space, and Technology, and in addition to the Committee on Education and Labor, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

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A BILL

To establish and support advanced geothermal research and development programs at the Department of Energy, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "Advanced Geothermal Research and Development Act of 2019".

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

Sec. 1. Short title; table of contents.
Sec. 2. Definitions.
Sec. 3. Hydrothermal research and development.
Sec. 4. General geothermal systems research and development.
Sec. 5. Enhanced geothermal systems research and development.
Sec. 6. Cost sharing and proposal evaluation.
Sec. 7. Advanced geothermal computing and data science research and development.
Sec. 8. Geothermal workforce development.
Sec. 9. Reporting requirements.
Sec. 10. Repeals.
Sec. 11. Authorization of appropriations.
Sec. 12. International geothermal energy development.
Sec. 13. Reauthorization of High Cost Region Geothermal Energy Grant Program.

SEC. 2. DEFINITIONS.

Section 612(1) of the Energy Independence and Security Act of 2007 (42 U.S.C. 17191(1)) is amended to read as follows:

"(1) ENGINEERED.—When referring to enhanced geothermal systems, the term 'engineered' means designed to access subsurface heat, including stimulation and nonstimulation technologies to address one or more of the following issues:

"(A) Lack of effective permeability, porosity or open fracture connectivity within the heat reservoir.

"(B) Insufficient contained geofluid in the heat reservoir.

"(C) A low average geothermal gradient which necessitates deeper drilling, or the use of alternative heat sources or heat generation processes.".

SEC. 3. HYDROTHERMAL RESEARCH AND DEVELOPMENT.

Section 613 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17192) is amended to read as follows:

"SEC. 613. HYDROTHERMAL RESEARCH AND DEVELOPMENT.

"(a) IN GENERAL.—The Secretary shall carry out a program of research, development, demonstration, and commercial application for geothermal energy production from hydrothermal systems.

"(b) PROGRAMS.—The program authorized in subsection (a) shall include the following:

"(1) ADVANCED HYDROTHERMAL RESOURCE TOOLS.—The research and development of advanced geologic tools to assist in locating hydrothermal resources, and to increase the reliability of site characterization, including the development of new imaging and sensing technologies and techniques to assist in prioritization of targets for characterization;

"(2) EXPLORATORY DRILLING FOR GEOTHERMAL RESOURCES.—The demonstration of advanced technologies and techniques of siting and exploratory drilling for undiscovered resources in a variety of geologic settings, carried out in collaboration with industry partners that will assist in the acquisi-

tion of high quality data sets relevant for hydrothermal subsurface characterization activities''.

SEC. 4. GENERAL GEOTHERMAL SYSTEMS RESEARCH AND DEVELOPMENT.

Section 614 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17193) is amended to read as follows:

"SEC. 614. GENERAL GEOTHERMAL SYSTEMS RESEARCH AND DEVELOPMENT.

''(a) SUBSURFACE COMPONENTS AND SYSTEMS.—The Secretary shall support a program of research, development, demonstration, and commercial application of components and systems capable of withstanding geothermal environments and necessary to develop, produce, and monitor geothermal reservoirs and produce geothermal energy.

''(b) ENVIRONMENTAL IMPACTS.—The Secretary shall—

''(1) support a program of research, development, demonstration, and commercial application of technologies and practices designed to mitigate or preclude potential adverse environmental impacts of geothermal energy development, production or use; and

"(2) support a research program to identify potential environmental impacts and environmental benefits of geothermal energy development, production, and use, and ensure that the program described in paragraph (1) addresses such impacts, including effects on groundwater and local hydrology;

"(3) support a program of research to compare the potential environmental impacts and environmental benefits identified as part of the development, production, and use of geothermal energy with the potential emission reductions of greenhouse gases gained by geothermal energy development, production, and use; and

"(4) in carrying out this section, the Secretary shall, to the maximum extent practicable, consult with relevant Federal agencies, including the Environmental Protection Agency.

"(c) RESERVOIR THERMAL ENERGY STORAGE.—The Secretary shall support a program of research, development, and demonstration of reservoir thermal energy storage, emphasizing cost-effective improvements through deep direct use engineering, design, and systems research.

"(d) OIL AND GAS TECHNOLOGY TRANSFER INITIATIVE.—

"(1) IN GENERAL.—The Secretary shall support an initiative among the Office of Fossil Energy, the Office of Energy Efficiency and Renewable Energy, and the private sector to research, develop, and demonstrate relevant advanced technologies and operation techniques used in the oil and gas sector for use in geothermal energy development.

"(2) PRIORITIES.—In carrying out paragraph (1), the Secretary shall prioritize technologies with the greatest potential to significantly increase the use and lower the cost of geothermal energy in the United States, including the cost and speed of geothermal drilling.

"(3) COPRODUCTION OF GEOTHERMAL ENERGY AND MINERALS PRODUCTION RESEARCH AND DEVELOPMENT INITIATIVE.—

"(A) IN GENERAL.—The Secretary shall carry out a research and development initiative under which the Secretary shall award grants to demonstrate the coproduction of critical minerals from geothermal resources.

"(B) REQUIREMENTS.—An award made under subparagraph (A) shall—

"(i) improve the cost effectiveness of removing minerals from geothermal brines as part of the coproduction process;

"(ii) increase recovery rates of the targets mineral commodity;

"(iii) decrease water use and other environmental impacts, as determined by the Secretary; and

"(iv) demonstrate a path to commercial viability.".

SEC. 5. ENHANCED GEOTHERMAL SYSTEMS RESEARCH AND DEVELOPMENT.

Section 615 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17194) is amended to read as follows:

"SEC. 615. ENHANCED GEOTHERMAL SYSTEMS RESEARCH AND DEVELOPMENT.

"(a) IN GENERAL.—The Secretary shall support a program of research, development, demonstration, and commercial application for enhanced geothermal systems, including the programs described in subsection (b).

"(b) ENHANCED GEOTHERMAL SYSTEMS TECHNOLOGIES.—In collaboration with industry partners, the Secretary shall support a program of research, development, demonstration, and commercial application of the

technologies to achieve higher efficiency and lower cost enhanced geothermal systems, including—

"(1) reservoir stimulation;

"(2) reservoir characterization, monitoring, and modeling;

"(3) stress and fracture mapping including real time monitoring and modeling;

"(4) tracer development;

"(5) three and four-dimensional seismic imaging and tomography;

"(6) well placement and orientation;

"(7) long-term reservoir management;

"(8) drilling technologies, methods, and tools;

"(9) improved exploration tools;

"(10) zonal isolation; and

"(11) understanding induced seismicity risks from reservoir engineering and stimulation.

"(c) FRONTIER OBSERVATORY FOR RESEARCH IN GEOTHERMAL ENERGY.—The Secretary shall support the establishment and construction of up to 3 field research sites operated by public or academic entities, which shall each be known as a 'Frontier Observatory for Research in Geothermal Energy' or 'FORGE' site to develop, test, and enhance techniques and tools for enhanced geothermal energy.

"(1) DUTIES.—The Secretary shall—

"(A) award grants in support of research and development projects focused on advanced monitoring technologies, new technologies and approaches for implementing multi-zone stimulations, and dynamic reservoir modeling that incorporates all available high-fidelity characterization data; and

"(B) seek opportunities to coordinate efforts and share information with domestic and international partners engaged in research and development of geothermal systems and related technology.

"(2) SITE SELECTION.—Of the FORGE sites referred to in paragraph (1), the Secretary shall—

"(A) consider applications through a competitive, merit-reviewed process, from National Laboratories, multi-institutional collaborations, institutes of higher education and other appropriate entities best suited to provide national leadership on geothermal related issues and perform the duties enumerated under this subsection; and

"(B) prioritize existing field sites and facilities with capabilities relevant to the duties enumerated under this subsection.

"(3) FUNDING.—Out of funds authorized to be appropriated under section 11 of the 'Advanced Geothermal Research and Development Act of 2019', there shall be made available to the Secretary to carry out the FORGE activities under this paragraph—

"(A) $45,000,000 for fiscal year 2020;

"(B) $55,000,000 for fiscal year 2021;

"(C) $65,000,000 for fiscal year 2022;

"(D) $70,000,000 for fiscal year 2023; and

"(E) $70,000,000 for fiscal year 2024.

In carrying out this section, the Secretary shall consider the balance between funds dedicated to construction and operations and research activities to reflect the state of site development.

"(4) ENHANCED GEOTHERMAL SYSTEMS DEMONSTRATIONS.—

"(A) IN GENERAL.—Beginning on the date of enactment of the 'Advanced Geothermal Energy Research and Development Act of 2019', the Secretary, in collaboration with industry

partners and institutions of higher education, shall support an initiative for demonstration of enhanced geothermal systems for power production or direct use.

"(B) PROJECTS.—

"(i) IN GENERAL.—Under the initiative described in subparagraph (A), demonstration projects shall be carried out in locations that are commercially viable for enhanced geothermal systems development, while also considering environmental impacts to the maximum extent practicable, as determined by the Secretary.

"(ii) REQUIREMENTS.—Demonstration projects under clause (i) shall—

"(I) collectively demonstrate—

"(aa) different geologic settings, such as hot sedimentary aquifers, layered geologic systems, supercritical systems, and basement rock systems; and

"(bb) a variety of development techniques, including open hole and cased hole completions,

differing well orientations, and stimulation mechanisms; and

''(II) to the extent practicable, use existing sites where subsurface characterization or geothermal energy integration analysis has been conducted.

''(iii) EASTERN DEMONSTRATION.—Not less than 1 demonstration project carried out under clause (i) shall be located in an area east of the Mississippi River that is suitable for enhanced geothermal demonstration for power, heat, or a combination of power and heat.''.

SEC. 6. COST SHARING AND PROPOSAL EVALUATION.

Section 617(b) of the Energy Independence and Security Act of 2007 (42 U.S.C. 17196) is amended by striking paragraph (2) and redesignating paragraphs (3) and (4) as paragraphs (2) and (3), respectively.

SEC. 7. ADVANCED GEOTHERMAL COMPUTING AND DATA SCIENCE RESEARCH AND DEVELOPMENT.

(a) IN GENERAL.—Section 618 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17197) is amended to read as follows:

"SEC. 618. ADVANCED GEOTHERMAL COMPUTING AND DATA SCIENCE RESEARCH AND DEVELOPMENT.

"(a) IN GENERAL.—The Secretary shall carry out a program of research and development of advanced computing and data science tools for geothermal energy.

"(b) PROGRAMS.—The program authorized in subsection (a) shall include the following:

"(1) ADVANCED COMPUTING FOR GEOTHERMAL SYSTEMS TECHNOLOGIES.—Research, development, and demonstration of technologies to develop advanced data, machine learning, artificial intelligence, and related computing tools to assist in locating geothermal resources, to increase the reliability of site characterization, to increase the rate and efficiency of drilling, to improve induced seismicity mitigation, and to support enhanced geothermal systems technologies.

"(2) GEOTHERMAL SYSTEMS RESERVOIR MODELING.—Research, development, and demonstration of models of geothermal reservoir performance and enhanced geothermal systems reservoir stimulation technologies and techniques, with an emphasis on accurately modeling heat flow, permeability evolution, seismicity, and operational performance over

time, including collaboration with industry and field validation.

"(c) COORDINATION.—In carrying out these programs, the Secretary shall ensure coordination and consultation with the Department of Energy's Office of Science. The Secretary shall ensure, to the maximum extent practicable, coordination of these activities with the Department of Energy National Laboratories, institutes of higher education, and the private sector.".

(b) CONFORMING AMENDMENT.—Section 1(b) of the Energy Independence and Security Act of 2007 (42 U.S.C. 17001 note) is amended in the table of contents by amending the item related to section 618 to read as follows:

"Sec. 618. Advanced geothermal computing and data science research and development.".

SEC. 8. GEOTHERMAL WORKFORCE DEVELOPMENT.

(a) IN GENERAL.—Section 619 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17198) is amended to read as follows:

"SEC. 619. GEOTHERMAL WORKFORCE DEVELOPMENT.

"The Secretary shall support the development of a geothermal energy workforce through a program that—

"(1) facilitates collaboration between university students and researchers at the national laboratories; and

"(2) prioritizes science in areas relevant to the mission of the Department through the application of geothermal energy tools and technologies.".

(b) CONFORMING AMENDMENT.—Section 1(b) of the Energy Independence and Security Act of 2007 (42 U.S.C. 17001 note) is amended in the table of contents by amending the item related to section 619 to read as follows:

"Sec. 619. Geothermal workforce development.".

SEC. 9. REPORTING REQUIREMENTS.

Section 621 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17200) is amended to read as follows:

"SEC. 621. REPORTS.

"(a) REPORT.—Every 5 years after the date of enactment of Advanced Geothermal Research and Development Act of 2019 , the Secretary shall report to the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate on advanced concepts and technologies to maximize the geothermal resource potential of the United States.

"(b) PROGRESS REPORTS.—Not later than 1 year after the date of enactment of the 'Advanced Geothermal Research and Development Act of 2019', and every 2 years thereafter, the Secretary shall submit to the Com-

mittee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the results of projects undertaken under this part and other such information the Secretary considers appropriate.''.

SEC. 10. REPEALS.

(a) IN GENERAL.—Subtitle B of title VI of the Energy Independence and Security Act of 2007 (42 U.S.C. 17191 et seq.) is amended by striking section 620.

(b) CONFORMING AMENDMENT.—Section 1(b) of the Energy Independence and Security Act of 2007 (42 U.S.C. 17001 note) is amended in the table of contents by striking the item related to section 620.

SEC. 11. AUTHORIZATION OF APPROPRIATIONS.

Section 623 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17202) is amended to read as follows:

''SEC. 623. AUTHORIZATION OF APPROPRIATIONS.

''There are authorized to be appropriated to the Secretary to carry out the programs under the 'Advanced Geothermal Research and Development Act of 2019'—

''(1) $100,000,000 for fiscal year 2020;

''(2) $111,125,000 for fiscal year 2021;

''(3) $122,250,000 for fiscal year 2022;

''(4) $128,375,000 for fiscal year 2023; and

"(5) $129,500,000 for fiscal year 2024.".

SEC. 12. INTERNATIONAL GEOTHERMAL ENERGY DEVELOPMENT.

Section 624 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17203) is amended—

(1) in subsection (a), to read as follows:

"(a) IN GENERAL.—The Secretary of Energy, in coordination with other appropriate Federal and multilateral agencies (including the United States Agency for International Development) shall support collaborative efforts with international partners to promote the research, development, and demonstration of geothermal technologies used to develop hydrothermal and enhanced geothermal system resources."; and

(2) by striking subsection (c).

SEC. 13. REAUTHORIZATION OF HIGH COST REGION GEOTHERMAL ENERGY GRANT PROGRAM.

Section 625 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17204) is amended—

(1) in subsection (a)(2), by inserting " or heat" after "electrical power"; and

(2) in subsection (e), to read as follows:

"(e) AUTHORIZATION OF APPROPRIATIONS.—Out of funds authorized under section 11 of the 'Advanced Geothermal Research and Development Act of 2019', there

1 is authorized to be appropriated to carry out this section
2 $5,000,000 for each of fiscal years 2020 through 2024.''.

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